UNIVERSITY OF ILLINOIS

April 30 1954

THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

EDWARD R. ANDERSON

ENTITLED RECONCEPTUALIZATION OF THE ENVIRONMENT AND

IMPLICATIONS FOR PREMATURE INFANT DEVELOPMENT

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF BACHELOR OF SCIENCE IN LIBERAL ARTS AND SCIENCES

Instructor in Charge

APPROVED:

HEAD OF DEPARTMENT OF PSYCHOLOGY

O-1364

RECONCEPTUALIZATION OF THE ENVIRONMENT AND IMPLICATIONS FOR PREMATURE INFANT DEVELOPMENT

BY

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THESIS

for the

DEGREE OF BACHELOR OF SCIENCE

IN

LIBERAL ARTS AND SCIENCES

College of Liberal Arts and Sciences

University of Illinois at Urbana-Champaign

Urbana, Illinois

1984

Abstract

Premature birth, like many neonatal traumas, has been linked to later developmental deficiencies, but a direct causal relationship has not yet been established. Investigations into the mediational effects of the environment have similarly failed to yield any clear relationship between the trauma of prematurity and later impairments in childhood. This paper sought to expand upon previous models of the environment by including paternal as well as maternal influences, and indirect influences of the parents beyond direct social interaction. Preterm and fullterm infants and their parents were studied from birth through eight months, with assessments being taken on infant developmental status, infant temperament, parental behavioral style, parental caregiving, and parental managerial influences. Results indicated that, from a univariate perspective, not many differences between preterms and fullterms could be identified. However, when viewed within a multivariate framework, it became clear that the environments of preterms and fullterms were indeed quite different. Parents of fullterms, as opposed to parents of preterms, provided a greater depth of variety in their interactions with their infants, and they continually encouraged the developmental advance of their infants. Furthermore, predictions of later development were improved using this framework. To the extent that parents of preterms were able to adapt their behavior to meet the particular capabilities of their infants, cognitive and motor development was enhanced. This research provides support for a multidimensional, transactional model of infant and family

development, and it is hoped that future research will be able to incorporate this view.

Acknowledgements

I would like to express my sincere appreciation to my advisor, Dr. Ross Parke, for his wisdom and genuine interest and ecouragement. I am grateful to Dr. Michael Coles for his constructive criticism and comments, and for his valuable support. I would like to express many thanks to Dave Gray for his assistance in the data analysis and for his help in general with computer problems. I would like to acknowledge the work of Lorraine Crummey, Carolyn O'Rourke, Carla Schmittler, and David Vermillion in the monumental task of data collection and coding. Finally, I would like to express special thanks to Elaine Fleming for her ability to coordinate a large number of tasks and a small number of people, for her time and effort in the recruitement of families, and for her constant encouragement and support.

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RECONCEPTUALIZATION OF THE ENVIRONMENT AND IMPLICATIONS FOR PREMATURE INFANT DEVELOPMENT

There exist a variety of neonatal traumas that may result in later developmental deficiencies. One in particular that has received attention is that of premature birth. Indeed, with advances being made in medical technology that allow even younger and more immature babies to survive, the problem of prematurity is becoming one of greater concern. Several characteristics are associated with premature birth that may place the infant at-risk for later developmental problems. These infants are unprepared to meet the demands of the environment (Goldberg, 1981), are less alert and responsive physically than fullterm infants (Brown & Bakeman, 1980), require special medical care (Klaus & Fanaroff, 1979), and, in general, look and behave differently than fullterms (Sameroff, 1981). In addition, preterm infants have been found to perform less optimally on assessment scales such as the Brazelton (Brazelton, 1974) than do fullterms (Field, 1980), and delays persist for higher-risk samples even at two years (Sigman & Parmelee 1979).

Although there appear to be poorer developmental consequences associated with prematurity, consistent evidence is not always found. Bakeman and Brown (1980), for example, found that prematurity alone did not predict social or cognitive ability when assessed at three years. Although their particular sample of premature babies was exceptionally healthy, other studies also show the limited predictive validity of outcome as a function of degree of risk (Beckwith & Cohen, 1980). It

seems that there is some set of mediating factors that interact with neonatal difficulties to affect later outcome.

Sameroff and Chandler (1975) have addressed this issue by proposing that

> transactions between the child and his caretaking environment serve to break or maintain the linkage between earlier trauma and later disorder and must...be taken into account if successful predictions are to be made. (p. 190)

For this reason, research has focused on those aspects of the infant's environment which are important for prediction of outcome. To date, however, conceptualizations of the caretaking environment have been limited. In reality, the infant interacts within a complex social network (Belsky, 1979; Pedersen, 1975; Parke & Tinsley, 1982) that is constantly changing, expanding, and being restructured (Sameroff & Chandler, 1975). Thus, to understand and predict the development of the preterm infant, research must not only consider the contributions of the infants themselves, but broaden the definition of the caretaking environment and investigate the interactions that take place within it.

Contributions of the infant

Preterm and fullterm infants differ from each other in a variety of ways and a description of infant characteristics that includes only prematurity as the critical dimension would be inadequate. An important distinction between infants is temperament. Children possess different temperamental characteristics from the moment of birth, "independently of their parent's handling or personality style" (Thomas, Chess, & Birch, 1970, p. 104) that persist throughout development (Thomas et al., 1970). Osofsky (1976) noted the importance of the characteristics of

the infant in the establishment of parent-infant relationships, and a number of researchers provide evidence for the inclusion of these relationships in predicting outcome (Beckwith & Cohen, 1980; Beckwith, Cohen, Kopp, Parmelee, & Marcy, 1976; Marton, Minde, & Ogilvie, 1981). This is especially relevant when preterm development is discussed, as preterms are more likely to be viewed as difficult infants (Field, 1980), and parents have reported that they were less likely to engage in interaction with a preterm infant (Frodi, Lamb, Leavitt, Donovan, Neff, & Sherry, 1978). Assessments of infant temperamental characteristics would be valuable for understanding the influences that infants bring to their interaction with the social environment.

Environmental Influences

Parent as interactant/caregiver

Past research on the environment of the developing infant has primarily been concerned with the role of the mother, although the importance of the father is finally being recognized (Belsky, 1979, 1981; Clarke-Stewart, 1978; Kotelchuck, 1975, 1976; Lamb, 1975, 1976a, 1976b; Lamb & Stephenson, 1978; Lewis & Weinraub, 1976; Marton, Minde, & Perotta, 1981; Parke, 1979, 1981; Parke & O'Leary, 1973; Parke, Power, & Gottman, 1979; Parke & Sawin, 1980; Parke & Tinsley, 1981, 1982; Pedersen, 1975; Pedersen, Yarrow, Anderson, & Cain, 1978; Pedersen, Yarrow, & Strain, 1975; Yogman, 1981). There are important differences in the way mothers and fathers contribute to the development of their infants which must be considered. Foremost among these are the differences in the amount of time spent interacting and caregiving, with

mothers more consistently involved in all facets of interaction with their infants (Belsky, 1979; Clarke-Stewart, 1978; Kotelchuck, 1975, 1976; Lamb, 1975; Lewis & Weinraub, 1976; Marton, Minde, & Perotta, 1981; Parke & Sawin, 1980). Fathers, on the other hand, spend a greater proportion of their time with their infants in play (Kotelchuck, 1976; Lamb, 1975), and this reflects some important qualitative differences between the ways fathers and mothers interact with their infants. Fathers tend to engage in more physical games (Parke & Tinsley, 1981) while mothers tend to be more verbal in their play style (Lamb, 1975). Feiring et al. (1975) report that the father provides more unique experience for his infant and his style serves to complement that of the mother. This variety in behavioral style provides the infant with a wide range of experiences and this, in turn, is positively related to later development (Clarke-Stewart, 1978). Since these differences in play style become more pronounced as the infant matures and is more capable of robust physical interaction, it has been postulated that the father's influence becomes stronger with time (Lamb, 1975).

The quantitative and qualitative differences found in fullterm families may not hold for families with preterms, however. Although Marton et al. (1981) found that mothers of preterms provided a higher amount of caretaking than fathers, the absence of a fullterm comparison group makes interpretation of this finding difficult. Moreover, there is some evidence to suggest that the differences between mothers and fathers in terms of quantity of caregiving provided for premature infants are not as marked as those shown for fullterm infants. A study by Lowman (1981) found that fathers of preterm infants showed a higher

degree of involvement than fathers of fullterm infants. In addition, Goldberg (1981) found that parents of preterms were less actively involved with their infants than parents of fullterms. Other researchers have reported that parental differences in play style were less prominent when the infant was premature (Marton, Minde, & Perotta, 1981; Parke & Tinsley, 1981), specifically, in the direction of less physical stimulation for fathers with preterm infants (Field, 1977). Moreover, the quality of the relationship between parent and preterm infant may be different. Brown and Bakeman (1980) found that mothers of preterm infants exerted more effort in parent-infant interaction because of the reduced activity of the preterm infants. Other researchers concur that the burden of interaction with a preterm infant falls upon the parent (Field, 1977, 1979; Goldberg, 1981), and that these interactions are predictive of later developmental problems (Field, 1979).

It is clear that the infant's environment consists of the joint influences of mother and father, both of which must be considered if an adequate description of the caretaking environment is to be made. Mothers and fathers differ both qualitatively and quantitatively in their interactions with their infants in ways that are important for development. However, such differences are not quite as clear with parents of preterm infants, so knowledge about parental influences as interactant and caregiver may be especially important.

Parent as manager/organizer of the infant's environment

A complete conceptualization of the environment of the developing infant recognizes the importance of not only the direct social context, but also the characteristics of the physical environment. Parents not only influence their infants directly by the way they feed and play with their babies, they indirectly influence their infants in that they manage and organize their households in ways that affect infant development (e.g., by providing toys and play spaces). These variables can all influence the child in subtle ways (Parke, 1978) and the role of the physical environment cannot be overlooked (Henderson, 1981; Parke, 1978; Power & Parke, 1982; Yarrow, Rubinstein, & Pedersen, 1975). This role as manager and organizer may be just as important as the role of interactant and caregiver, since the amount of time infants spend interacting with their inanimate environment far exceeds their social interaction time (Power & Parke, 1982; White, Kaban, Shapiro, & Attanucci, 1977). Henderson (1981) lists a number of characteristics of the parent as manager which seem to be particularly important for development. These include provision for the child's safety, varied and patterned sensory input, few restrictions on exploration, a well organized physical environment, and provision of appropriate play materials. Specifically, it has been found that children whose mothers encouraged development and provided appropriate play materials showed an increase in mental test performance (Henderson, 1981). The way parents mediate the inanimate environment through their selection of toys for the infant has been shown to be important for cognitive and motivational development (Yarrow et al., 1975). The most important variable in these

findings appears to be the variety of inanimate stimulation the infant receives (Yarrow et al., 1975), just as the variety of stimulation in social situations was strongly related to later development.

The physical environment seems to be particularly important for preterm development because the stress surrounding the birth of a preterm infant could very well result in a more disorganized environment with less variety of stimulation. These factors have been associated with low IQ scores (Henderson, 1981). To date, however, research has been lacking in its assessments of the physical environment of the preterm infant.

It is therefore readily apparent that a more thorough understanding of the environment, one that considers the qualitative and quantitative differences between both parents in their roles as interactant and caregiver, is necessary to predict preterm development. The parental role as manager and organizer of the environment may be equally important, and it, too, deserves further investigation. With an expanded view of the environment that includes these aspects, we are better equipped to understand the role played by the environment in mediating infant development, as well as the relationships between neonatal and environmental characteristics which may serve to ameliorate early developmental deficiencies.

METHOD

Participants

Participants for the study included 44 infants and their families from the Champaign-Urbana area or proximity. Twenty-five of the infants

were fullterm, thirteen males and twelve females, and nineteen of the infants were preterm, ten males and nine females. Criteria for selection of premature infants included birth weight under 2500 grams, 37 weeks gestational age or less at birth, and absence of any severe physical, sensory, or neurological handicaps. In addition, all families were Caucasian and intact, and infants were of singleton birth with no prenatal, perinatal, or postnatal complications.

Two separate matching procedures were used for the group of preterm infants. Ten of the preterm infants were matched with fullterm infants in terms of gestational age. These comprised the premature-gestational group. Nine of the preterm infants were matched with fullterms as a function of post-hospital social experience. These comprised the premature-experiential group. Since preterm infants vary greatly in terms of duration of hospital stay, age and amount of post-hospital experience can easily become confounded. This is an important consideration since the experiences the infant receives in the hospital are qualitatively different from those in the home. Therefore, the schedule of assessments for the premature-experiential group followed from departure from the hospital, whereas the schedule of assessments for the premature-gestational group followed from 40 weeks postconception age, regardless of duration of hospital stay.

Description of assessments

The Brazelton Neonatal Behavioral Assessment Scale (Brazelton, 1974) assesses such things as the newborn's reflexes, response patterns, and attentiveness, and as such is indicative of the infant's sociability.

This scale was administered at the hospital and the three week home visit and was used as a partial assessment of infant characteristics.

The Perception of Infant Temperament Scale developed by Pedersen and his colleagues (Pedersen, Zaslow, Cain, Anderson, & Thomas, 1977) assesses temperament using a q-sort procedure on a variety of scales. These include the infant's activity, rhythmicity, and adaptability, the infant's overall level of positive mood, and how readily the infant approaches novel situations (see Appendix A). Statements regarding various aspects of infant behavior were presented on index cards to mothers and fathers separately at each timepoint. The parent decided how well each of the statements described their infant by placing the index cards in appropriately labeled envelopes.

The Bayley Scales of Infant Development (Bayley, 1969) are a measure of infant cognitive and motor advancement. These were administered at three, eight, and twelve month home visits to the families by trained individuals.

Parents were asked to record the amount of caretaking they provided their infants during the course of one week using a diary provided by the project. The diary measures the quantity of feeding, diapering, bathing, and playing provided by both the mother and father. Families were asked to keep the diary for one week following each of the home visits and to indicate which parent provides the caregiving and the time of day this caregiving occurs. A supplementary methodological study was conducted to determine the reliability of the parental diary record as a measure. With the exception of dyadic play, parents were found to be moderately reliable at recording caregiving information, with

parent-observer correlations being around .60 for each of the activities. Although dyadic play time did not reach similar levels of reliability, records of triadic (mother-father-infant) play interaction did reach levels similar to those of the other activities. A detailed report of this study is provided in Appendix B.

The Home Observation for Measurement of the Environment (HOME) developed by Caldwell and associates (Caldwell, Huder, & Kaplan, 1966) is a combined interview and observation assessing six facets of the infant's environment: (1) emotional and verbal responsivity of the parent, (2) avoidance of restriction and punishment, (3) parental involvement with the child, (4) opportunities for variety in daily stimulation, (5) organization of the physical and temporal environment, and (6) provision of appropriate play materials (see Appendix C). The HOME inventory seems to predict cognitive outcome reasonably well (Henderson, 1981) and has also been empirically validated (Hollenbeck, 1978) in that it discriminates between diverse populations in predicted ways. This inventory was given by trained individuals during each of the home visits.

Procedure

Recruitment of participants

Names of potential families to be used in this study were obtained from birth announcements in local newspapers. Families were recruited from Mercy Hospital and the Carle Foundation Hospital in the Champaign-Urbana area. The neonatal intensive care units were used for recruitment of families of preterm infants. Families were approached in

the hospital and given an explanation of the project and an offer to participate. At the conclusion of their involvement in the project, the families were paid $50.00.

Observations

Observations investigated four types of parent-infant interaction: a) father-infant unstructured dyad, b) mother-infant unstructured dyad, c) mother-father-infant unstructured triad, and d) mother-father-infant structured triad feed context. Observations were conducted by trained individuals who recorded parent and infant behaviors on a model DAK-8 Datamyte portable keyboard recorder. The datamyte stores behavior codes along a time sequence, allowing for both frequency and duration of behaviors to be generated.

The coding system used is a numerically coded set of both parent and infant behaviors. Parent behaviors were divided into seven general categories: a) holding patterns, b) caretaking activities, c) visual activities, d) facial expressions, e) vocalizations, f) touching patterns, and g) miscellaneous physically stimulatory activities. Infant behavior codes included three categories: a) infant state, b) social patterns, including facial expressions, vocalizations, and distress cues, and c) location codes. A description of the coding system is provided in Appendices D and E.

Measures of parent-infant interaction were made at each of five timepoints: at the hospital, and during home visits at three weeks, and three, eight, and twelve months. Home observations for the premature-gestational group took place at 40 weeks gestational age plus

the timepoints mentioned above, and home observations for the premature-experiential group were measured after discharge from the hospital. Inter-observer reliability was also determined at each of the timepoints. The reliability coefficients for the codes used in the present analysis are provided in Table 1.

Insert Table 1 about here

Thus, at all home visits, the parents were given a diary to record caretaking behaviors during the week, and temperament scales were administered to the mother and father. The HOME Inventory and observations were conducted, as well as an assessment of infant development. Although the project is nearing completion, twelve month data has not yet been collected for the entire sample and hence will not be presented here.

RESULTS

Multiple analyses of variance

Multiple analyses of variance were conducted on the temperament, diary, HOME inventory, and observational data, using a split-plot factorial design. Results for each of these measures will be presented separately.

Temperament

Analyses were conducted on all the subscales and the composite scores, for the hospital separately, and again across all timepoints. A significant main effect of infant condition was obtained for the hospital composite score ($F = 3.328$, $p < .05$), and the composite score across timepoints ($F = 5.712$, $p < .01$). The lowest scores were found in the preterm-experiential group and the highest scores were found in the preterm-gestational group. Higher scores on the temperament scale indicate a more "easy" temperament, and lower scores indicate a more "difficult" temperament. In addition, a significant main effect of timepoint was obtained ($F = 329.99$, $p < .001$), with scores increasing steadily across timepoints. An interaction between infant condition and timepoint was also found ($F = 2.812$, $p < .02$), suggesting that both age and birth status affect ratings of temperament. There were no differences between the ratings of mothers and fathers for any of the subscales or composite scores.

For the subscale of positive mood, an interaction betwen infant sex and parent sex indicated that fathers gave higher ratings of positive mood to their baby boys than to their baby girls, and mothers gave higher ratings of positive mood to their baby girls than to their baby boys ($F = 4.597$, $p < .05$). An effect of timepoint showed that the highest ratings of positive mood were reported in the hospital and the lowest ratings were reported at the three week timepoint ($F = 7.147$, $p < .002$). Ratings of positive mood increased steadily across timepoints, but they never reached those reported at the hospital. These results were typical of all the conditions.

HOME inventory

A main effect of timepoint ($F = 17.219$, $p < .001$) was found for the composite score and all the subscales, indicating a steady increase in the quality of the home environment over time for all the conditions. On the subscale of parental involvement with the child, the results indicate that parents were more involved with their fullterm infants than with their preterm infants ($F = 4.109$, $p < .026$). On the subscales dealing with the provision of appropriate play materials, a status by timepoint interaction occurred ($F = 3.747$, $p < .003$). This indicated a large differences favoring fullterms at the three week timepoint, but no differences at later timepoints.

Diaries

Only one main effect for all the contexts of feeding, diapering, bathing, and playing was found: that of parent sex (average $F = 141.00$, $p < .001$). Mothers were consistently more involved in all facets of caregiving across all timepoints and all conditions. No other main effects or interactions were found. It appears that mothers still carry most of the burden of child care even if the infant is premature. Fathers were not found to be more involved in caregiving with their preterm infants than with their fullterm infants.

Observational data

Mothers were found to be more verbal and affectionate, and provided more caregiving in their interactions with their infants than fathers (see Tables 2 and 3). These differences were true of all the conditions, suggesting that the traditional distinction between mothers

and fathers is also true of parents of preterms. Indeed, in terms of interactional style, the analyses of variance revealed no distinction between parents of preterms and parents of fullterms. Parents of fullterms, however, interacted more with each other in the triad contexts than did parents of preterms (see Table 4).

Insert Tables 2 and 3 about here

The overall level of activity was reduced in the triad context over the dyad context, replicating earlier findings of second-order effects (cf. Tables 2 and 3). The results also indicate that overall activity was higher in the unstructured context than in the feed context (see Table 5). These findings underscore the need for including several contexts when studying development.

Insert Tables 4 and 5 about here

Correlational analyses

Pearson product moment correlation coefficients were calculated for the temperament, HOME inventory, and Brazelton scores with the mental and psychomotor developmental indices of the Bayley scales. Only those correlations reaching conventional levels of significance will be reported.

The hospital Brazelton score and the HOME inventory score at three weeks were positively correlated with the three month Bayley scores, but correlations with the eight month Bayley scores were not significant. The highest correlation found was between the HOME score and the psychomotor development index ($r = .48$, $p < .001$). The other correlations were all around .30. Temperament scores at three weeks were negatively correlated with development at eight months ($r = -.32$, $p < .01$).

Discriminant function analyses

Since no clear effects of infant condition were found in terms of interactive differences in the analyses of variance, a discriminant function analysis was performed in order to identify those variables which would be most important for distinguishing among the conditions. Separate analyses were run for each timepoint, with similar clusters of variables remaining significant across all timepoints. The variables found to be most important at the eight month timepoint were the Bayley scales, the HOME score, and the parental behaviors of father bounce/toss/lift, mother affectionate behaviors, mother vocalize to infant, mother present object, and caregiving behaviors of both parents. These variables, along with their standardized coefficients for the discriminant functions, are listed in Table 6. To evaluate the discriminatory power of the functions which were generated, classification of predicted group membership based on the functions was performed. The percent of groups correctly classified was 97.67, which was all but one of the cases.

Insert Table 6 about here

Examination of the coefficients of these variables on the discriminant functions revealed that fathers of fullterms were more physical in their interactions than fathers of preterms. Mothers, on the other hand, were less verbal with their fullterm infants than with their preterm infants, but they were also more affectionate with fullterms than with preterms. In addition, both parents provided more caregiving to their preterm infants than to their fullterm infants. The HOME inventory score was higher in the fullterm condition than in the preterm conditions, and with regards to temperament, fullterms were rated as more difficult than preterms. As expected, fullterms had higher mental and psychomotor development scores than preterm infants. Again, this particular pattern was representative of those found for all the timepoints. The fact that these results were only revealed when using the multivariate model of the discriminant analysis as opposed to the univariate model of the analyses of variance, stresses the importance of viewing development in terms of an expanded, multivariate model.

Regression analyses

Regression analyses were performed for each condition separately and for the entire combined sample at each timepoint, using the three and eight month Bayley scales as the dependent variables. For the preterm-experiential group, mental and psychomotor development at eight

months could successfully be predicted (R-squared = .9994, R-squared = .9998, respectively). variables. 4 detailed profile of the regression analyses for the premature-experiential group is provided in Tables 7-12. The predictions were less powerful for the preterm-gestational and the fullterm groups, and weaker still when the entire sample was analyzed as a single unit. Moreover, successful predictions of developmental status at eight months could be made for the preterm-experiential group as early as the hospital ($F = 1869.17$, $p < .018$), suggesting that early interactions can play an important role for developmental outcome. Not suprisingly, different variables played different roles for outcome depending on the infant's condition. What appeared particularly revealing, however, was that variables could play different roles at different timepoints for infants in the same condition. For example, the mother behavior of poke/pinch was positively related to development of the experiential group at eight months when investigated at the hospital. This same behavior, however, was negatively related to development of the experiential group when investigated at the three week timepoint. From a univariate perspective, this would appear extremely confusing, but considered within a dynamic, multivariate framework, in which the parent continually modifies his or her behavior to meet the capabilites of the infant, it is not entirely suprising.

Insert Tables 7 to 12 about here

DISCUSSION

Although the results in general support the need for incorporating a multivariate model, a discussion of each of the components of the model will be presented first, followed by a synthesis of the multivariate model and its relation to later development. Finally, implications of this research for future work in this area will be discussed.

Effects of infant temperament

Although the analysis of the temperament data revealed differences among the three groups, the interpretation of these analyses is not readily apparent. The lowest scores, as expected, were found in the experiential group, but the highest scores were found in the gestational group. The explanation for this finding may become clear when the effects of timepoint are included. All the temperament scores increased across time, indicating that the chronological age of the infant may have some effect on the ratings of the infant's temperament. The gestational infants were chronologically the oldest in the sample, even though in terms of post-conception age they were the same as the fullterms. If this fact is considered, it may not be the birth status of the infant which most affects temperament, but rather the chronological age. Indeed, the particular scale that was used is standardized for infants which are somewhat older. Infants with easy temperament are defined, for example, as being more rhythmic in bodily functions and more adaptable to new situations--characteristics which are typical of more older infants.

The differences found in terms of positive mood ratings may have some implications for family development as well. The fact that ratings of positive mood were highest in the hospital and lowest at the very next timepoint, three weeks later, reveals that perhaps the excitement of having a new baby wears off once the baby arrives home and the realistic demands of child care must be met. At the hospital, the new parents do not have to deal with fussing and crying babies or 3 a.m. feedings, but once at home, they begin to realize that their bundle of joy can indeed be quite demanding at times. Ratings of positive mood increase steadily over time as the parents become adjusted to the particular temperament and routines of their baby, but at eight months, the infant is still not judged as highly on positive mood as he or she was in the hospital. Previous research on family development (e.g., LeMasters, 1957) has shown that the addition of a new baby into the family is a very stressful time and one that may result in less overall satisfaction, and the results from this analysis seem to support this view.

Effects of parent as manager and organizer

The results from the HOME inventory scale reveal differences in the managerial styles of parents of fullterms and parents of preterms. While there were no differences in terms of the composite score, there were some important differnces on several of the subscales.

Parents of fullterms were found to encourage more consciously the developmental advance of their infants by structuring their play periods, challenging the development of new skills, and providing

appropriate play materials. Parents of fullterms were more likely to provide activities and toys which were slightly beyond the child's level, which helped to encourage the infant to develop new skills. In terms of quantity of inanimate materials, fullterms had a greater number at three weeks, but this difference disappeared by three months. This is not suprising when we remember that preterm infants arrive sooner than expected. Parents of preterm infants have thus not yet prepared the infant's environment in terms of play materials. After time, however, parents of preterms reach similar levels to those attained by parents of fullterms. The regression analyses show that this aspect of the parent as manager--encouraging developmental advance by challenging new skills and providing appropriate play materials--is positively related to later development, especially for very young infants.

Effects of parent as interactant and caregiver

In terms of quantity of caregiving provided, the results show that mothers are consistently more involved than fathers, and this difference is also true of parents of preterms. In terms of qualitative differences, mothers are more verbal and affectionate than fathers in their interactions with their infants, and, again, this difference is also true for parents of preterms. In a univariate sense, parents do not seem to treat their preterm infants differentially. However, data from the discriminant analysis show that there are indeed some important differences in the treatment of pre- and fullterm infants, but that these must be considered in combination with one another. Fullterm infants did not only have fathers who were more physical in their

interactions, they also had mothers who were more affectionate and feeling-oriented in their interactions. This suggests that parents of fullterms provided a wider variety of interactive styles, not just a greater quantity of one behavior over another. This is also underscored by the higher scores on the HOME inventory for fullterm infants. Their parents provided a wider range of activities and play materials which challenged a number of new skills, and it was not just that parents of fullterms interacted more with their infants or provided more of one type of activity. Viewing the parental role as an interactant from a multivariate perspective enables a clearer picture of the differing environments of pre- and fullterm infants to emerge.

Consequences for development

The regression analyses show that successful predictions for later development can be made using a multivariate framework. Different variables appear to be more important depending upon the status of the infant, which was expected. The results show that more variables are needed to predict development for the older preterm infants and the fullterm infants, respectively. Prediction becomes less powerful as more variables become influential, and it must be kept in mind that a linear prediction of development has some inherent problems. Nevertheless, certain features of the environment can be identified which were predictive of later developmental outcome as early as the hospital.

For the experiential group, it appears that certain tactile stimulation provided by the mother in the hospital is positively related

to development at eight months. The maternal behavior of poke/pinch was much more strongly weighted than any of the other variables in the regression equation. For the other groups, more affectionate behaviors (e.g., kiss, nuzzle, and smile) and more robust physical stimulation appeared to be more influential. At three weeks, however, the same behavior of mother poke/pinch was negatively related to development, suggesting that the experiential infants had matured to a level where such stimulation was no longer necessary, and in fact, potentially disruptive.

As the infants grew older, different behaviors of the parents seemed to have more of an impact. For example, the managerial behaviors of the parents appeared to have their greatest influence at three months. This finding is not surprising, since a certain level of motor maturity must be reached before the infant is capable of the tasks which the parents seek to encourage and develop.

The three week timepoint appeared to be a critical transition period. Few of the variables seemed to have had any major impact, and for the experiential group, outcome was predicted mainly by what the parents did not do: fathers who did not provide much tactile or physical stimulation and parents who did not attempt to present objects to their infant's visual field had infants who performed better at eight months.

The most critical variable throughout the regression analysis, however, seemed to be the capability of the parents to adapt their behavior to the infant's particular abilities. For the youngest infants, this meant limiting interaction to brief tactile stimulation at first, then gradually incorporating other activities. Again, to better

understand how experience mediates development, we must use a transactional model that considers a wide range of infant and parental behaviors.

The preterm infant's environment: A synthesis

It is readily apparent that the environments of preterm and fullterm infants are indeed quite different, but it is necessary to go beyond a simplistic, univariate model to an expanded, multivariate model that considers the transactions that take place between the characteristics of the infants and the direct and indirect influences of the infant's environment. Such a model recognizes that the environment is vastly complex, that it is constantly changing and being influenced by a great many factors. The changes that the environment imparts upon the infant themselves become responsible for altering the environment, and this process continually cycles around. To draw an analogy with atomic physics, it is impossible to to completely capture the environment at a single point in time, just as the electrons of an atom can never be said to exist in a single sphere of the atom; they are constantly in motion and influencing the orbits of other electrons.

What, then, can be said of the environments of preterm and fullterm infants? In general, it appears that the preterm infant's environment consists of a smaller range of experiences in terms of interaction with their parents. Preterms are exposed to much less variety in terms of stimulation, and hence, do not have the opportunity to develop new skills which are important for advancement. Additionally, parents do not actively encourage developmental advancement with preterm infants as

they do with fullterm infants. As the infants slowly mature with time, parents begin to expose their preterm infants to a wider range of experiences, and development is accelerated. It must be emphasized, however, that more variabilty exists in the population of preterms. This particular pattern is by no means characteristic of all preterm families. It is for this reason that past research has failed to establish a direct relationship with outcome based upon status of the infant at birth.

Implications

This research has shed some light on the problems of past investigations which sought to establish causal links between premature birth and later developmental outcome. A direct model was not possible, because the environment serves to mediate neonatal trauma. Past conceptualizations of the environment, too, were inadequate, in that they neglected some very important characteristics, such as the direct and indirect influences of both mother and father. The inclusion of these variables has served to enhance our understanding of the differences between the environments of preterm and fullterm infants, and to identify those clusters of variables which are positively related to later development. It is also important to recognize that environmental variables interact with infant characteristics to form a system which is constantly being restructured. Future research will illuminate further the dynamics of this system and will enable clinicians to apply this knowledge to the development of intervention programs which will assist parents of high-risk premature infants in making informed decisions about parenting.

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Table 1

Reliability Coefficients for Behavior Codes

Used in the Present analyses

	Mother	Father
Code	Unstructured	Unstructured
check/adjust	.69	.92
look at infant	.96	.96
vocalize to infant	.93	.41
smile at infant	.72	.75
smooth touch	.90	.91
bounce/toss/lift	.86	.85
kiss/nuzzle	.87	.94
rock infant	.77	.61
present object	.57	.61
poke/pinch	.61	.51
look to spouse	.83	.29
smile to spouse	.85	.52
vocalize to spouse	.40	.79

Table 2

Mean Values of Mother and Father Behaviors

for the Dyad Context

Parent behaviors	Mother	Father	F-value
check/adjust	10.61	8.92	4.18*
vocalize to infant	584.06	493.42	9.03**
smooth touch	22.48	17.18	9.45**
kiss/nuzzle	4.49	2.77	6.492*
bounce/toss/lift	7.14	8.31	1.10
present object	100.04	95.98	.09

* $p < .05$

** $p < .01$

Table 3

Mean Values of Parent Behaviors

for the Triad Context

Parent behaviors	Mother	Father	F-value
check/adjust	6.00	3.17	38.26*
vocalize to infant	362.48	210.51	59.93*
smooth touch	10.41	7.25	13.25*
kiss/nuzzle	1.17	.93	1.86
bounce/toss/lift	2.80	2.58	.38
present object	44.67	44.05	.01

* $p < .001$

Table 4

Mean Values of Parent Interactive Behaviors

by Infant Condition

	Condition			
Behavior	PE	PG	FT	F-value
Look to spouse	87.72	57.98	152.54	6.41**
smile to spouse	2.39	1.53	3.00	4.06*
vocalize to spouse	195.16	153.83	280.818	5.84**

Note. PE = Premature-experiential

PG = Premature-gestational

FT = Fullterm

* $p < .03$

** $p < .006$

Table 5

Mean Values of Parent Behaviors

for Triad Feed vs. Triad Unstructured

	Activity		
Parent behavior	Feed	Unstructured	F-value
check/adjust	4.11	5.07	14.28
vocalize to infant	238.93	333.06	59.60
smooth touch	6.79	10.87	20.79
kiss/nuzzle	.50	3.89	49.64
bounce/toss/lift	1.50	3.89	21.95
present object	7.94	80.78	52.87

Note. All p's < .001

Table 6

Discriminant Function Variables

and Their Standardized Coefficients

	Function 1	Function 2
father--check/adjust	-.539	-.044
father--bounce/toss/lift	.750	.605
mother--check/adjust	-.796	.265
mother--vocalize to infant	-.347	.419
mother--smooth touch	.702	-.416
mother--bounce/toss/lift	-.478	-.118
mother--kiss/nuzzle	.757	-.326
mother--present object	-.635	.653
temperament score	-.431	-.696
mental development index	.515	.118
psychomotor development index	.864	.300
HOME inventory score	.433	-.549
quantity of triad play	.516	.469

Table 7

Hospital Variables as Predictors of

8-Month Mental Development

for the Premature-Experiential Group

	coefficient
Temperament	-.068
mother--smooth touch	-.678
Brazelton score	-.889
mother--poke/pinch	9.300
mother--check/adjust	.963
father--smooth touch	.422
mother--rock infant	-.218

F = 1869.17

p < .018

R-squared = .9994

Table 8

Hospital Variables as Predictors of

8-Month Motor Development

for the Premature-Experiential Group

	coefficient
Temperament	-1.267
father--rock infant	1.110
mother--poke/pinch	7.810
father--bounce/toss/lift	1.466
Brazelton score	-.680
father--vocalize to infant	-.027
father--poke/pinch	.760

F = 5781.49

p < .01

R-squared = .9998

Table 9

Three Week Variables as Predictors of

8-Month Mental Development

for the Premature-Experiential Group

	coefficient
father--smooth touch	-.968
father--check/adjust	-2.590
father--bounce/toss/lift	-.913
father--vocalize to infant	.040
mother--present object	-.014
father--present object	-.019
mother--quantity of interaction	-.015

F = 19111.388

p < .006

R-squared = .9999

Table 10

Three Week Variables as Predictors of

8-Month Motor Development

for the Premature-Experiential Group

	coefficient
mother--poke/pinch	-2.571
father--present object	.076
quantity of triad interaction	-.236
HOME inventory score	2.240
father--rock infant	1.870
mother--kiss/nuzzle	-.900
father--smile at infant	-.320

F = 39292.864

p < .004

R-squared = .9999

Table 11

Three Month Variables as Predictors of

8-Month Mental Development

for the Premature-Experiential Group

	coefficient
mot..er--present object	.047
HOME inventory score	2.822
mother--quantity of interaction	.178
father--quantity of interaction	-.202
father--vocalize to infant	.017
mother--poke/pinch	.926
mother--vocalize to infant	.069

F = 28237.57

p < .005

R-squared = .9999

Table 12

Three Month Variables as Predictors of

8-Month Motor Development

for the Premature-Experiential Group

	coefficient
father--smooth touch	-.812
quantity of triad interaction	-.253
HOME inventory score	1.431
father--check/adjust	1.103
mother--vocalize to infant	-.015
mother--present object	.027
mother--quantity of interaction	.018

F = 884370.809

p < .001

R-squared = .9999

APPENDIX A

PEDERSEN TEMPERAMENT SCALE

Activity

1. During diapering and dressing, she squirms and kicks much of the time. She is so active that I sometimes have trouble doing these tasks.
2. During a bath, she kicks, splashes, and wiggles. She is full of activity at these periods.
3. Her play with toys is active. She often kicks her legs and waves her arms.
4. She seldom sits still for very long when I place her in a stroller or infant seat.
5. Even when I play with her very quietly, she typically moves her arms, legs, and body a great deal.
6. She usually lies still during diapering and dressing. She rarely squirms and kicks during these activities.
7. She lies quietly when she first awakens from a nap. She does not become physically active quickly.
8. She tends to be quiet when I feed her. She rarely squirms, kicks, or moves her arms.
9. She usually lies fairly still during sleep. She awakens in just about the same position she was in when she fell asleep.
10. When vocalizing or babbling, she moves very little. She doesn't kick or wave her arms at these times.

Rhythmicity

11. She likes to be fed at or about the same time each day. Hungry times do not vary by more than about half an hour from day to day.
12. She generally takes a nap at about the same time each day. Her nap time does not vary by more than half an hour from one day to the next.
13. She does not vary by more than half an hour from one day to the next as to when she falls asleep at night.
14. The times when she wants to be fed and to go to sleep stay about the same even if our household routine varies from day to day.
15. If she has a fussy period, it occurs at about the same time every day.
16. She is unpredictable in when she wants to be fed. Hungry times vary by more than one hour from day to day.
17. It is hard to anticipate how much she will eat each day. She usually doesn't take the same amount of milk or food from day to day.
18. She rarely naps for the same length of time from day to day. The length of her daytime naps varies by more than half an hour from one day to the next.
19. She rarely sleeps at night for the same length of time. The number of hours she sleeps at night varies by more than half an hour from one day to the next.
20. The times when bowel movements occur show no particular pattern from one day to the next.

Adaptability

21. She is immediately comfortable in new surroundings, such as a friend's house.
22. If we take her to a friend's house, she doesn't seem to mind going to sleep in an unfamiliar bed or crib.
23. When I tried to change her nap or bedtime, she adjusted to the new routine in a day or two.
24. If I give her a food she doesn't like at first, she usually comes to accept it after one or two feedings.
25. When I changed her feeding schedule, she adjusted to the new routine within a day or two.
26. It takes her 10 minutes or more to become comfortable in new surroundings.
27. When I interrupt her ongoing activity to change her diaper or her clothes, she shows that she doesn't like this by fussing or crying.
28. She really doesn't like other people to feed or diaper her. She's most comfortable with familiar people.
29. It was hard to discourage her nighttime feeding.
30. When something is happening which interrupts her routine (e.g., when we go on a trip or have people visiting) she has periods of fussing or crying.

Positive Mood

31. She almost always smiles and seems happy when she wakes up from a nap.
32. I can almost always count on her having a period each day when she is happy and requires almost no attention.
33. There are many times during the course of a day when she shows delight and pleasure in the activity in which she is engaged.
34. When she's fussing or crying, she often calms herself down before I need to do anything.
35. She hardly ever becomes fussy or cranky except when she needs to sleep. to be fed, or to be diapered.
36. When she wakes up from a nap, she is often a bit fussy.
37. She almost always has a fussy period each day.
38. There are times when she fusses or cries and nothing seems to console her.
39. When my attention is drawn elsewhere, she rapidly becomes irritable or fussy.
40. When I soothe her, even after she stops crying, it takes her a while to return to a good mood.

Approach

41. If I give her a new toy or other object to play with, she takes it right away, and looks it over.
42. When I take her along on a shopping trip, she seems to enjoy the new sights and sounds.
43. When she sees another baby or child, she shows a lot of attention and interest.
44. When I take her to a friend's house, she shows a lot of interest in all the new things in her surroundings.
45. She immediately turns to find out where a new sound is coming from.
46. Often, she doesn't play with a new toy or object right away. She seems to warm up to new objects gradually.
47. When I try out a new activity with her, such as swinging or using a jumper or walker, she is usually a little apprehensive at first.
48. She prefers familiar toys to new toys I give her.
49. When a visitor comes over and spends some time in our home, she's more interested in her familiar toys than in the new person.
50. She usually shows a little hesitation before accepting a new food I give her.

APPENDIX B

SUPPLEMENTARY METHODOLOGICAL STUDY

Child care involvement has typically been assessed by means of an interview (e.g., Kotelchuck, 1975). Investigations into the validity of this method caution about interpretations based upon data which are only moderately reliable (Kotelchuck, 1975). An alternative is to provide parents with a diary to record caregiving as it occurs. This method of recording quantity of caregiving is a relatively new procedure in developmental research. As such, its reliability as a measure is in question. It was therefore necessary to conduct a supplementary methodological study in addition to the main study to assess the usefulness of the parental diary record as a tool for research.

METHOD

Participants

Participants for the study included 20 families from the Champaign-Urbana area, similar in composition to those in the main study. Ten of the families included a three-month-old infant, and ten, an eight-month-old infant. Equal numbers of male and female infants comprised both groups.

Names of potential participants were derived from birth announcements in local newspapers and were recruited via a telephone interview. The study was described to the parents, and they were given an offer to participate. At the conclusion of their involvement in the study, the families were paid $10.00.

Procedure

The main study employs a diary which allows for the measurement of caretaking behavior in six-hour intervals (e.g., midnight until 6 a.m., etc.). This study employed an identical diary, but also included a diary which used two-hour intervals as the measure (e.g., 6 a.m. until 8 a.m., etc.). Parents were asked during the telephone interview to select a day of the week which was fairly routine and diary records were taken on these days. Parents were requested to record their activities of bathing, feeding, diapering, and playing with the baby, using the 6-hour block diary, for one day during the first week. The same day the following week, parents recorded activities using the two-hour block diary. The third and final week of their involvement, parents again recorded daily activities using the six-hour block diary on the same day of the week as for the preceeding two weeks.

During the second week of involvement, two trained observers visited the family for a two-hour time period and recorded the quantity of feeding, diapering, bathing, and playing that took place, using a form similar to the diaries already mentioned. The observations were scheduled at a convenient time when both parents were present.

With this study, it was possible to determine the extent to which parents reliably record their caretaking behaviors. Assuming that little variation in a daily routine takes place across a span of three weeks, the record of the coders should approximate that of the parents.

RESULTS

Pearson product moment correlation coefficients were calculated for each of the contexts of diapering, feeding, bathing, and playing to assess three areas: inter-coder reliability, reliability between the parents and the coders, and stability of caregiving across three weeks.

Inter-coder reliability ranged from .74 in the feeding context to 1.0 in the bathing context. The correlation coefficients for all contexts are reported in Table 1.

Insert Table 1 about here

Correlations between parental reports and coder reports ranged from .54 to .62 for the contexts of diapering, feeding, and bathing. Correlations in the play contexts ranged from .095 for the mother-infant dyad to .63 for the mother-father-infant triad. These correlations are also summarized in Table 1.

Correlations were calculated for all contexts for three sets of scores: week one with week two, week two with week three, and week one with week three. These are presented in Table 2.

Insert Table 2 about here

DISCUSSION

Inter-coder reliability was high for all contexts. The relatively low correlation of .74 for the feeding context is somewhat misleading; closer examination of the coder's reports show only two instances when the coders disagreed. The correlations for the play situations were quite high, given the ambiguity of the play situation.

Parent-coder reliability for the caregiving tasks show a moderately strong relationship, replicating the results reported by Kotelchuck (1975) for data obtained from interviews. The diary method of recording caregiving is about as reliable as data obtained from interviews, and thus we are no closer to a true description of caregiving routines using the parental diary record. The author concurs with Kotelchuck in that "there is no simple solution to the problem of obtaining accurate child care information" (Kotelchuck, 1975, p. 7). Nevertheless, it can be concluded that parents are at least moderately reliable in recording quantity of caregiving, but as before, caution must be taken in interpreting findings.

In the context of play, however, an interesting result is found. Although parent-coder reliability is absent for the mother-infant dyad (.095), it is reasonably strong in the triad situation (.63). This finding provides some insight into parent-infant interaction. Dyadic interaction is a very ambiguous situation--that is, it is difficult to define what constitutes "play" with a young infant. Several parents expressed difficulty in recording their play time, since, they report, "play is intertwined with so many other activities." Parents "play"

with their babies as they bathe them, for example, and often, especially in the case of a very young infant (e.g., three months), the attempt to soothe the infant by feeding him or her can result in a short bout of "play." In a triadic situation, however, it seems much more clear that the interaction is a play episode. Play time is different from mere interaction time and researchers must incorporate this distinction when drawing conclusions about quantity of interaction.

The correlations between scores for the three weeks show that the assumption of stability is quite well supported. A very strong relationship was not expected, as household routines with an infant less than a year old are likely to be somewhat unstable. The two types of diaries did not yield differences in the recording of caregiving, although one mother did report that the 2-hour block diary was much easier to use, since having to fill it in every two hours kept the task foremost in her mind and made it "easier to judge accurately how much time was spent playing."

In summary, this study shows that parents are moderately reliable in recording their own caretaking behaviors, and more importantly, that a clearer definition of play time is needed. The triad of mother, father, and infant seems to provide stronger agreement on play time, whereas dyadic situations may reflect a more general interaction time.

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Kotelchuck, M. (1975). Father caretaking characteristics and their influence on infant-father interaction. Paper presented at the 83rd Annual Convention of the American Psychological Association, Chicago, Illinois.

Table 1

Reliabilities for

Parental Records of Caregiving

Context	Parent-coder	Inter-coder
diapering	.54	.97
feeding	.55	.74
bathing	.62	1.0
mother dyadic play	.095	.79
father dyadic play	.26	.86
triadic play	.63	.79

Table 2

Three Week Stability Coefficients

for Parental Diary Records

context	week 1/week 2	week 2/week 3	week 1/week 3
diapering	.42	.49	.56
feeding	.62	.70	.67
bathing	.36	.54	-.02
mother dyadic play	.50	.72	.65
father dyadic play	.56	.72	.57
triadic play	.42	.81	.67

APPENDIX C

HOME OBSERVATION FOR MEASUREMENT OF THE ENVIRONMENT

I. EMOTIONAL AND VERBAL RESPONSIVITY OF MOTHER AND FATHER

1. Parent spontaneously vocalizes to child at least twice during visit (exclude scolding).
2. Parent responds to child's vocalizations with a vocal or verbal response.
3. Parent tells child the name of some object during visit or says name of person or object in a "teaching" style (e.g., provides a label).
4. Parent's speech is distinct, clear, and audible to interviewer.
5. Parent initiates verbal interchanges with observer--asks questions, makes spontaneous comments.
6. Parent expresses ideas freely and easily and uses statements of appropriate lenghth for conversation (e.g., gives more than brief answers).
7. Parent permits child occasionally to engage in "messy" types of play (score NO at birth and three weeks; ask about at three months) (includes food).
8. Parent spontaneously praises child's qualities or behavior twice during visit (evidence of pride in the child).
9. When speaking of or to child, parent's voice conveys positive feeling.
10. Parent caresses or kisses child at least once during visit.
11. Parent shows some positive emotional responses to praise of child offered by visitor.

II. AVOIDANCE OF RESTRICTION AND PUNISHMENT

12. Parent does not shout at child during visit.
13. Parent does not express overt annoyance with or hostility towards child (i.e., child "driving me up wall," no humor intended).
14. Parent reports that no more than one instance of physical punishment occurred during the past week (parental definition of punishment).
15. Parent does not scold nor derogate child during visit.
16. Parent does not interfere with child's actions or restrict child's movements more than three times during visit.
17. Parent neither slaps nor spanks child during visit.
18. At least ten books are present and visible (adult or child books--if valued as a possession).
19. Family has a pet.

III. PARENTAL INVOLVEMENT WITH CHILD

20. Parent tends to keep child within visual range and to look at him ofte n (as appropriate for age, to insure safety and interpersonal contact).
21. Parent "talks" to child while doing her work (idea of inclusion).
22. Parent consciously encourages developmental advance (finds ways to help & encourage child to roll over, learn patty-cake, hold toy, track).
23. Parent invests "maturing" toys with value via her attention. Offers and encourage toys, activities slightly beyond child's level.
24. Parent structures child's play periods (occasional suggestions of things to do).
25. Parent provides toys that challenge child to develop new skills.

IV. OPPORTUNITIES FOR VARIETY IN DAILY STIMULATION

26. Father provides some caregiving every day.

27. Parent reads stories to child at least three times weekly.

28. Child eats at least one meal per day with mother and father (conversational inclusion important).

29. Family visits or receives visits from relatives approximately once a month.

30. Child has three or more books of his own.

V. ORGANIZATION OF PHYSICAL AND TEMPORAL ENVIRONMENT

31. When parent is away, care is provided by one of three regular substitutes (includes older sibling).
32. Someone takes child into grocery store at least once a week.
33. Child gets out of house at least four times a week (includes out in yard).
34. Child is taken regularly to doctor's office or clinic for check-ups and preventive health care (as appropriate for age).
35. Child has a special place in which to keep his toys or "treasures." (may be a shared space with older child)
36. Child's play environment appears safe and free from hazards (clutter and/or overcrowding NOT included).

VI. PROVISION OF APPROPRIATE PLAY MATERIALS

37. Child has one or more muscle activity toys or equipment (e.g., crib gym, ball, rocking horse, jumpseat, etc.).
38. Child has push or pull toy.
39. Child has stroller, walker, kiddie car, scooter. or tricycle.
40. Provides learning equipment--mobile, table and chairs, high chair, playpen.
41. Provides other learning equipment (appropriate to age--cuddly toy or role playing outfit).
42. Provides eye-hand coordination toys--fit together beads or toys, things that go into each other.
43. Provides eye-hand coordination toys that permit combinations--stacking or nesting toys, blocks or building toys.
44. Provides toys for literature and music--records, musical instruments (appropriate to age; musical rattle, baby book).
45. Parent provides toys or other interesting activities for child during interview (special effort to interest the child in something).

VII. OTHER TOYS IN VIEW

46. Moving parts

47. Squeezes

48. Mirror

49. Makes noises

50. At least three different colors

51. Different tactile patterns

52. Different visual patterns

53. Unusual shape

APPENDIX D

PARENTAL BEHAVIORAL CODE SYSTEM

Codes that end with a "1" are durations and those that end with a "2" are frequencies. The beginning "c" denotes caregiver and is either coded a "1" indicating mother or "4" indicating father. Codes underlined are used only when observing older infants at 8 or 12 months of age.

C1 HOLD CODES

C111 Touch (no hold). Caregiver passively touches infant's body or part of body; lays hand, still, on infant; hold's infant's hand, arm, leg in hand without moving hand. This code applies only when caregiver is not holding infant. When caregiver is holding infant (121, 131, 141) a touch would be coded as C612. C111 is often seen as a passive support of the baby, e.g., caregiver holds baby's arms to help baby stand--usually at 8 or 12 months--or propping baby into a sitting position on floor or couch. Infant's body must be on couch, floor, bed, etc., not on caregiver's lap. This can also be used when caregiver allows part of his/her body to be used by child for support, e.g., child propped against parent's knees.

C121 Hold close. Caregiver holds baby snuggly and securely against own torso, encircling baby with arm(s) in a type of horizontal cradle. Baby must be held firmly against caregiver. When infant is held close to caregiver's body, but propped on caregiver's arm (arm not encircling infant), code as C121 if baby is indeed in contact with caregiver's body and propped against caregiver's upper arm. Includes holding baby against shoulder for burping (vertical position). If caregiver changes position from cradle to against shoulder for burping, the C121 remains and this shift is coded C232 (shift, adjust). Distinguish C121 from C111, C131, and C141.

C131 Hold distal, loose. Baby is lying or sitting on caregiver lap, knees, stomach, or arm and is loosely held with minimal support from caregiver's arms or hands; baby is not held snuggly against caregiver's body. This includes a horizontal "cradle" when baby is propped against caregiver's lower arm loosely. Distinguish from C111, C121, C141.

C141 Hold facing outward. Baby is held such that his/her back is facing the caregiver's stomach. The front of the baby's body is facing outward, away from the caregiver. Use C141 when caregiver is burping baby when baby is lying on his/her stomach across caregiver's lap, facing down. This includes "piggy back" when caregiver places baby on shoulders, usually seen at 8 and 12 months. Distinguish from C111, C121, C131.

C100 Terminates all holds.

N.B. C111, C121, C131, C141, C100 are mutually exclusive and exhaustive.

C2 CARETAKING ACTIVITIES

C211 Feeding. Caregiver has nipple in baby's mouth. No feeding takes place within the sleep states; Baby must be alert or drowsy. This also includes spoon feeding before 8 and 12 montns.

C222 Stimulates feeding. Regular, rhythmic movement of nipple (bottle or breast) or finger by caregiver in the area of the baby's mouth in order to stimulate sucking by baby during feeding. Enter once for each cluster or sequence of such stimulation. Code C222 for any touch to the baby's cheek while nipple is in the baby's mouth. You may code a C222 without a C211 if parent is stimulating without the nipple actually being in the baby's. If caregiver is feeding and does a C222 by moving the nipple quickly out of and into the baby's mouth, just code C222, not C211, C200, C211. Stimulation with a pacifier is coded C762 following C731 (present object) if the pacifier has first been presented to the infant's visual field.

C232 Wipes, grooms, cleans, checks, shifts, or adjusts. Caregiver physically and visually inspects, checks, and/or adjusts any aspect of infant clothing, bunting, etc. (except nipple or bottle); e.g., checks diapers, adjusts clothing or wraps, covers baby or adjusts covers, adjusts baby's position in bed or infant seat. Involves physical activity of caregiver, i.e., use of hands. Caregiver wipes baby's face and/or hands; brushes or combs baby's hair with brush, comb, or hand; clips fingernails or cleans any other part of baby's body. Record each event or cluster of movements. This also includes parent adjusting wires or tapes, etc., attached to preemies in neonatal unit. Code C232 for any adjustment of position within the same hold code, e.g., a change from cradled to against the shoulder. Includes feeling baby's stomach for tension or gas, and shading eyes against light.

C241 Bathe. Caregiver is engage in behaviors associated with bathing the baby. All behaviors which are included in this sequence of behaviors but could be coded separately (e.g., C632, C642, C612) need not be coded during the bathing sequence unless these behaviors are performed in addition to normal bathing type behaviors.

C251 Change diaper. Caregiver is engaged in the behaviors associated with diaper changing. All behaviors which are included in this sequence of behaviors but could be coded separately (e.g., C232,

C612) need not be coded unless these behaviors are performed in addition to regular diaper changing (e.g., rubbing baby's head).

C261 Burping. Caregiver pats or rubs baby to stimulate burping. Will always occur during a hold pattern (C1). Use only when you are sure the caregiver is "burping"--usually after a feeding activity. Distinguish C261 from C612. C612 can also occur during C261, e.g., a stroke on the baby's head while also patting baby's back.

C292 Physical assistance to spouse. Caregiver under observation aids spouse physically in some way, e.g., holds bottle, passes a burp cloth, gets a toy, helps adjust baby's position, etc. This code is used only for a caregiver who is not holding the baby.

C281 Caregiver feeds other than bottle or breast. This includes all the aspects of dispensing food to the child, such as: loading the spoon, waiting, loading food onto the child's spoon, handing out finger food, handing child a cup, etc. Distinguish from C731 (present object), which occasionally occurs during a feeding situation: e.g., when spoon or cup is waved around to attract the attention of the child in a highly exaggerated way. Terminate after 8 seconds of caregiver passivity. This code is used at 8 and 12 months only.

C200 Terminates C211, C241, C251, C261, C281.

C3 VISUAL ACTIVITY

C311 Looking at baby. Caregiver's head and eyes are oriented toward any part of the baby, i.e., looking at baby in any place or any way, visually attending to the infant.

C391 Attends spouse. Caregiver's head and eyes are oriented away from the baby and toward the spouse, i.e., caregiver is not looking at baby or other parts of the room but is looking at the spouse. If parent is looking towards spouse and infant, code C311. During the dyad observations, C391 is coded even if only A glance.

C300 Terminates all looking patterns, C311, C391. Watch for C300 when parent is holding or burping the infant on his/her shoulder. Two second look away is sufficient. This is also used when parent looks away to another child, T.V., pet, etc.
N.B. C311 and C391 terminate each other, so glance to spouse does not involve C300 or waiting for two second rule.

C4 FACIAL EXPRESSIONS

C412 Laugh, smile at infant. Caregiver smiles or laughs at infant. Must occur during C311, i.e., C311 must preceed C412.

C482 Negative look to spouse. Caregiver frowns, glares, etc., at spouse. This must occur during C391, i.e., C391 must preceed C482.

C492 Laugh or smile at spouse. Caregiver laughs or smiles at spouse. This must occur during a C391, i.e., C391 must preceed C492.

C5 VOCAL BEHAVIOR

C511 Vocalize to infant. Caregiver talks or makes other vocalization to infant, includes singing, humming, clicking tongue, etc.

C582 Imitate infant vocalizations. Caregiver imitates vocalizations of baby. A C582 can occur without a C511, however, if it occurs within a streak of vocalization to the infant, you need to code the C511 also. This includes imitating yawns, hiccups, sneezing, babbling when definitely audible. Speaking for the infant is not a C582. If the caregiver takes on a baby voice and talks for the baby, this is a C511.

C591 Vocalize to spouse. Caregiver talks or makes other vocalization to spouse. This terminates C511 and vice versa.

C552 Negative vocalization to infant. This includes negative tone in parent's voice or use of "no" words even in a pleasant tone of voice. It may occur during C511 but not necessary. Used at 8 and 12 months only. This includes verbal restriction, e.g., "Oh no you don't" and "no, no, don't cry."

C500 Terminates all vocalizations. Silence for 4 seconds is sufficient.
N.B. As long as a vocalization is going on, it is coded from beginning to end as a single C511 or C591. Terminate any vocalization only after the vocalization is followed by four seconds of silence. If a vocalization is continued before a 4 second count is complete, it is considered part of the original voacalization.

C6 TOUCHING PATTERNS

C612 Touch, palmar or smooth in nature. This includes giving infant caregiver's finger to hold or suck. All stroking is coded C612 and patting with large part of hand. During burping a C612 is a stroke or pat on the baby's back or tummy. It can include touching with one or two fingers as long as it is not the fingertips. Code in clusters of single occurrences, e.g., if a parent is stroking on the side of the baby's head repeatedly, that is a cluster, coded C612 once. If parent changes to other side of baby's head, enter another C612.

C622 Staccato touch with fingertips, pinch or poke. This code is for poking and tapping movements, patting baby with fingertips. Tickling with a single finger is a C622. Tapping with all four fingers is a C6222. Code in clusters or single occurences. Almost all other touches will fall into the C612 category. Tickling with a whole hand is a C642.

C632 Intrusive touch. This is to be coded in addition to one of these: C612, C622, C642, C652, or C682. It describes the effect of a touch and cannot occur alone.
N.B. In distinguishing what is an intrusive touch, much depends upon the infant's state. A stimulating touch when applied to a fussy baby would be considered intrusive, whereas the same motion applied to a content baby would not be intrusive. This is probably going to be the case most of the time, though there are some motions which would be considered intrusive regardless of the infant's state or reaction, e.g., shaking hard or outright hitting. These will rarely occur. A touch which is considered intrusive, then, will first of all be coded C612, C622, C642, C652, or C682 and immediately followed by C632 to indicate its being inappropriate or intrusive considering the baby's state. In editing, the C632 code will be changed to have the same time of occurence as the code indicating the type of touch.

C642 Bounce, toss, lift, stretch arms. Caregiver moves baby or parts of baby in stimulatory fashion; physical game sorts of activities. Includes holding baby's legs and moving them with kicking or walking motions; also includes any sort of bouncing, tickling with the whole hand, or jiggling and shaking legs, hands, or tummy. Code in distinct occurences. Each time caregiver stops and begins again, enter another C642. This does not include rocking infant on a rocking horse (which is an infant behavior, coded 71 with the location 05) or when infant is not actually being touched by caregiver. It does include an 8 or 12 month old infant being pushed on a moving toy.

C652 Kisses or nuzzles. Caregiver kisses and/or nuzzles baby with mouth or face; i.e., any contact of caregiver's face with any part of baby's body.

C682 Rock. Caregiver moves all or almost all of baby's body in rhythmic movements such as swinging self and baby with back and forth torso rotations while sitting, standing, or walking. This includes rocking chair. Code in distinct occurences, such that each time the caregiver stops and starts again another C682 is coded. This does not include infant rocking itself on rocking horse or when infant is not actually being held by the parent. This is a caregiver code only. If caregiver is seated in a rocking chair and rocking continuously enter a C682 at beginning, then enter additional C682s only following discernable breaks.

C662 Cregiver lifts whole body of baby up into air, deliberately--not just while adjusting position, C232--or tosses baby or holds off lap or floor.

C672 Any physical restriction of the 8 or 12 month old child. This includes restricting infant from crawling away from parent, parent taking an object away from child, parent preventing child from putting object into its mouth.

C7 MISCELLANEOUS BEHAVIOR

C731 Presents object. Caregiver holds toy, bottle, hand within infant's visual field. This is usually accompanied by efforts to catch infant's attention, e.g., shaking object, vocalization, etc. This includes presenting finger or hand, only when not associated with tracking. In the case of looking at books, a C731 is coded with initial presentation, and terminated when book is put aside; the parent pointing out pictures in the book comes under the initial C731. This code includes presenting food to 8 or 12 month old child, but only when spoon or cup is waved around to attract the attention of the child in a highly exaggerated way. In the case of a pacifier a C672 may or may not be preceeded by a C731. It depends on whether or not the pacifier is first presented to the infant's visual field. When parent's hand leaves the pacifier, terminate, C700.

C700 Terminates object presentation. C731 is terminated whenever caregiver is not actively presenting object. Re-enter C731 with each new presentation.

C712 Explore, examine. Caregiver carefully examines infant's body or part of body with intense interest and concentration; must involve both looking and touching components. Often seen when parent is checking fingers, toes, facial rash, etc.

C722 Tracking with object. Caregiver moves object slowly and smoothly

across infant's visual field (horizontal or vertical movement), or makes a noise with object to the side of the baby's head. Code each individual sweep with object as one occurence. If there is any hesitation between them, i.e., if caregiver moves object from left to right, pauses, and moves object back from right to left, code as two occurences. Also code as a new occurence when pattern of movement changes (e.g., changes from vertical movement to horizontal). C722 is usually preceeded by C731; in the case of auditory only object tracking, a C731 may not occur.

C752 Tracking with body or voice. Caregiver moves body or body part, e.g., head or finger, slowly or smoothly across infant's visual field, or vocalizes to the side of the baby's head. See above, C722 for occurence determinates. C752 may occur without a C731 but C731 should be coded when body part is presented to infant's visual field first.

C762 Touch with object, stimulatory. Caregiver touches baby with object in a stimulating fashion. This includes giving lemon swabs to baby in hospital, putting baby's hand around object, giving baby pacifier and/or holding pacifier in baby's mouth. This code can occur without a C731. An oxygen hose to infant in neonatal care, unless touching, need not be coded.

C772 Touch with object, intrusive. Caregiver touches baby with object in an intrusive manner. This describes the effect of C762 and can not be used alone. See note for distinguishing intrusive touching patterns under C632, to help distinguish C772.

C441 Game. Parent and infant both involved in reciprocal play activity. This can be either with an object, e.g., ball back and forth, or without, e.g., pattycake or peekaboo, when the infant makes definite and deliberate contribution. This takes over from 71 and C731, i.e., 71 and 0731 must be terminated before beginning of C441.

C400 Terminates game.

PRESENCE OF OTHERS

1811 The indicates the presence of the wife during the father dyad.

4811 This indicates the presence of the husband during the mother dyad.

1800
4800 Terminates 1811 and 4811.
N.B. As both parents should be present at all dyads, these codes

must appear--C811 at beginning and C800 at end--in all dyads. Do not use in triads. If a spouse leaves a triad situation for a short time, e.g., to fetch a cloth, terminate behavior, looks, vocs, etc. Re-enter when spouse returns.

7811 Other present. This code is entered when a nurse or sibling or someone other than spouse comes in contact with the person under observation. At the hospital time point, this includes instances when a nurse comes to give assistance to a caregiver and when a caregiver seeks out help of some sort. During the time that another is interacting with the caregiver, the behaviors of the caregiver which are directed towards the other are ignored, e.g., vocalizations to the other are not coded. If they occur during a vocalization to infant or spouse (C511, C591), a terminate is entered at the beginning of the vocalization to the other. The same applies to look codes (C311, C391). Enter a C300 when person being observed looks to other. Interactions between other and infant are ignored. When interaction is taking place over some distance, e.g., across the nusery, code 7811 only while conversation is taking place. Terminate (7800) at end of conversation. Code 7811 when the other is within five feet of the people being coded and is oriented toward the infant and/or parent, whether conversation is continuous or not. At the home visit time points, 7811 indicates presence of a sibling, a telephone call, or someone coming to the door. It does not include pets. If a sibling is present and the telephone rings, the telephone call can not be recorded.

7800 Terminates 7811.

APPENDIX E
INFANT CODE SYSTEM

31 Eyes open. This includes eyes partly open, one eye open or partly open, as well as both eyes open wide.

30 Eyes closed. This means both eyes are closed, and is used to follow a 31, i.e., unless a 31 has been recorded, it is assumed that the baby's eyes were closed throughout.

42 Smile, laush. Baby smiles and/or laughs. Record onset of each clearly distinguishable smile or cluster of laugh sounds. This includes reflexive smiles.

51 Fussing. This records a persistant complaining noise that is somewhat sustained but not as intense as crying. It does not include discrete single fussing vocalizations that occur sporadically.

52 Vocalization, coo, babble. Infant emits any vocalization that can not be clearly identified as a cough, gas, spitup, sneeze (see 72), laugh (see 42), cry (see 91), or burp (see 62). Included in this category are such vocalizations as grunting, groaning, cooing, humming, and babbling. These vocalizations may occur during feeding as well as at other times, but do not include sucking or swallowing noises, hiccupping or breathing noises.

54 Continual vocalization of an 8 or 12 month old infant. This code takes over from 52 when 52s occur closer together than 7/100 of a minute. 54s can be edited in later if you see a string of them in such a close time.

50 Terminate fuss (51) or voc (54) after 4 seconds of silence.

62 Burps. Baby emits a clearly audible burp. Coder must hear the burp and not go on parent's report of one.

72 Cough, sneeze, spitup, gag, choke, gasp anytime, not just during feeding.

82 Startle. Baby produces sudden, abrupt gross motor movement, usually including flexing of arms. Startles often follow loud noises or sudden bright light (e.g., flash on camera). This movement is never focused nor directed toward contact with person or object, it is a momentary reflexive movement.

91 Cry. Baby produces a full blown enduring cry, i.e., a highly active distress state. Distinguish from 52. In preterm infants, the audible portion of the cry may not be enduring, i.e., it may be intermittent, but the other manifestations--scrunched up face, open mouth, red face and/or body--will be displayed. This is coded 91 even though the sound is intermittent. It is possible to go from 51 to 91 and back again without terminates.

90 Terminates 91, crying.

71 Grasp or manipulate. This is coded when an 8 or 12 month old child grasps an object, including food, hair, clothing, parts of the body rubbing a flat surface, touching a pet, etc. This does not include the infant holding onto an object, e.g., table or chair or edge of playpen, solely for purposes of support or balance or in order to raise him/herself into a standing position. Each time an infant picks up an onject and drops it, a 71 and a 70 is recorded, thus a rapid sequence of 71, 70 can occur. If the infant is grasping an object and a 71 is entered, then he/she picks up another object in the other hand, the 71 already entered will apply. If the child puts down one of the objects and keeps holding the other the 71 is still in effect. A 70 is entered when both hands are empty.

70 Terminates grasp or manipulate. This is entered when infant's hands are both empty. Used at 8 and 12 months only.

73 Shows object. This is a frequency code to record infant showing, offering, pointing to, or drawing attention of parent to, or seeking help with, an object. The infant does not need to be holding the object. Used at 8 and 12 months only.

69 Infant seeks to be held. This does not necessarily involve the infant touching the parent.

24 Self-feed. This will often be accompanied by a 71, but can occur by itself if the infant picks up food and puts it directly into its mouth. Used at 8 and 12 months only.

INFANT STATES AND DEFINITIONS (from Brazelton, 1974)

6112 Deep sleep. Infant is in deep sleep with predominantly regular breathing, eyes closed; no eye movements under closed lids; relaxed facial expression; no spontaneous activity except isolated startles, jerky movements or tremors at quite regular intervals.

6122 Light sleep. Infant is in light sleep with eyes closed; rapid eye movements can be observed under closed lids; low activity level, with diffuse movements and startles; movements are likely to be of lower amplitude and more monitored than in deep sleep; responds to various internal stimuli with dampened startle. Respirations are irregular, sucking and mouthing movements occur off and on; whimpers may be observed, as well as sighs, smiles, facial twitching and grimacing.

6132 Drowsy, semi-dozing. Infant is drowsy or semi-dozing; eyes may be open or closed, eyelids fluttering or exaggerated blinking; if

eyes open, glassy veiled look; activity level variable, with interspersed, mild startles from time to time; diffuse movement; fussing and/or mild vocalization or whimper may occur.

6142 Alert, minimal motor movement. Infant is awake and quiet with a minimal amount of motor activity, eyes open but with a glazed look, giving impression of little involvement and distance. May be focused yet seems to look through, rather than at object or examiner. Eyes may be wide open, "hyperalert," giving the impression of panic. Seems to be unable to modulate or break the intensity of the fixation. Motor activity is at a minimum.

6152 Alert, considerable thrashing. Eyes may or may not be open, but infant is clearly awake and aroused with considerable motor activity. May have mildly distressing facial expression, and may be fussing but not crying.

6162 Crying. Intense crying, as indicated by intense grimace and by face. Cry sound may be very weak or robust and vigorous in sound.

INFANT LOCATION CODES

6011 Isolette in hospital.

6021 Hospital bassinette with wires or other medical constraints attached to infant.

6031 Hospital bassinette without wires or other medical constraints attached to infant.

6041 Caregiver lap.

6051 Infant seat or high chair, swing, walker, rocking horse, etc.

6061 Floor.

6071 Couch or sofa.

6081 Crib or bed.

6091 Caregiver lap with medical constraints, e.g., with wires or tubes attached to infant.

INFANT LOCOMOTION CODES

Used when the infant is 8 or 12 months old.

6912 Lying down.

6922 Sitting down.

6932 Creeping. Distinguish from crawling, 6952. Baby does not use hands and knees to crawl, but uses arms and leg movements

6942 Use of mechanical aid, walker.

6952 Crawling. Standing on hands and knees.

6962 Standing.

6972 Walking, holding on. Walking with support from object or caregiver.

6982 Walking, free. No support necessary.